Technical Note
e-Notification
No. 07
March 9, 2020

Technical Note 07

1. BIO Updates for New Asset IDs

When a new Asset ID is issued to an existing structure (e.g. due to parallel structures being separated) or a structure currently in design or under construction, National Bridge Inventory (NBI) records should be identified and quantified using all available information (e.g. plans, inspection reports, and the site assessment). Record these items on the Data Correction Form as *Recommended Corrected Data* and update in Bridge Inspection Online (BIO). Items that have no available information, or information that cannot be easily attained during a routine site assessment, can be left blank in BIO (and should be added during the next routine inspection).

Any changes to the inspection type and/or frequency (NBI Items 91, 92A-C and 93A-C) should be reported through the SCDOT LR Inspection Type Spreadsheet. For parallel structures being separated into two asset ID's, the inspection dates, frequencies, and applicable condition ratings should be translated from the old Asset ID to the new Asset ID. Add a comment in the *Miscellaneous Notes* section stating, "Inspection dates, frequencies, and applicable condition ratings have been updated based on the structure's old Asset ID, [XXXXX], during the load rating contract. No inspection performed."

2. Live Load Distribution Factors for Channel Beams

The Skinny Leg Channel Visual Guide, attached to this Technical Note, should be utilized when setting Live Load Distribution Factors for 2 ½" wide ("skinny leg") Channel Beams. The results in the guide were produced from a load testing analysis for these bridge types by WSP, specifically for the load rating project, to determine if better factors could be realized by testing representative bridges in South Carolina. The resulting factors are an improvement over standard factors and should be employed to the extent possible.

3. Naming Convention and Future Wearing Surface Consideration for Bridges in Design

Per Load Rating Guidance Document (LRGD) Section 4.4, FHWA requires all new bridges to be load rated prior to the bridge opening to the public. To ensure the design is adequate and to capture the as-let condition of the new bridge, two separate superstructure definitions shall be generated in the AASHTOWare BrR file for new bridges in design. The first definition shall neglect the additional weight due to the future wearing surface (reflecting the as-let condition), and the second definition shall consider the weight due to the future wearing surface (reflecting the future condition). The future wearing surface shall be applied to the load rating model in accordance with the SCDOT Bridge Design Manual and applicable memorandums. Format specifics of the superstructure definition description boxes are as follows.

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For the definition that neglects the FWS weight:

[*Span Number(s)*] As-let Condition ([*Date*]) created by [*Consultant name or SCDOT*] ([*Load rater's initials*]) [*source and date of as-let information if not existing plans*]

[*Span Number(s)*] As-let Condition ([*Date*]) checked by [*Consultant name or SCDOT*] ([*Checker's initials*]) [*source and date of as-let information if not existing plans*]

For the definition that includes the FWS weight:

[*Span Number(s)*] Future Condition ([*Date*]) created by [*Consultant name or SCDOT*] ([*Load rater's initials*]) [*source and date of future condition information if not existing plans*]

[*Span Number(s)*] Future Condition ([*Date*]) checked by [*Consultant name or SCDOT*] ([*Checker's initials*]) [*source and date of future condition information if not existing plans*]

Similarly, the general description box of the bridge definition window shall be populated with the as-let and future conditions. Format specifics of the general description box are as follows:

As-let Condition created by [*Consultant name or SCDOT*] ([*Load rater's initials*]) ([*Date*])
As-let Condition checked by [*Consultant name or SCDOT*] ([*Checker's initials*]) ([*Date*])
Future Condition created by [*Consultant name or SCDOT*] ([*Load rater's initials*]) ([*Date*])
Future Condition checked by [*Consultant name or SCDOT*] ([*Checker's initials*]) ([*Date*])

Note: The dates associated with both the "As-let Condition" and "Future Condition" definition should be the date the plans are signed and sealed, since the letting date will not yet have been established.

Once the bridge is constructed, an "As-built" definition should be added to the BrR file in accordance with LRGD Section 20.3. If no changes are made that would affect the load rating input between the "As-let Condition" and the "As-built" condition, the "As-let Condition" should be renamed to "As-built," and the dates of the "As-built" and "Future Condition" should be updated accordingly. Otherwise, new "As-built" and "As-built Future" definitions should be added to reflect the as-built condition with and without a future wearing surface, respectively.

For example:

A single span bridge is signed and sealed on March 2, 2020. The general description box in the BrR model is populated as follows:

As-let Condition created by Consultant123 (ABC) (2020-03-02)
As-let Condition checked by Consultant123 (XYZ) (2020-03-02)
Future Condition created by Consultant123 (ABC) (2020-03-02)
Future Condition checked by Consultant123 (XYZ) (2020-03-02)

And the two superstructure definitions are named as follows:

As-let condition, not including future wearing surface:

Span 1 As-let Condition (2020-03-02) created by Consultant123 (ABC) based on bridge plans ID P123456-B01
Span 1 As-let Condition (2020-03-02) checked by Consultant123 (XYZ) based on bridge plans ID P123456-B01

As-let future condition, including future wearing surface:

Span 1 Future Condition (2020-03-02) created by Consultant123 (ABC) based on bridge plans ID P123456-B01
Span 1 Future Condition (2020-03-02) checked by Consultant123 (XYZ) based on bridge plans ID P123456-B01

The bridge is constructed and as-built plans, signed September 14, 2021, include modifications that affect the load rating input. “As-built” and “As-built Future” definitions are added to the model. The general description box now reads as follows:

As-let Condition created by Consultant123 (ABC) (2020-03-02)
As-let Condition checked by Consultant123 (XYZ) (2020-03-02)
Future Condition created by Consultant123 (ABC) (2020-03-02)
Future Condition checked by Consultant123 (XYZ) (2020-03-02)
As-built created by Consultant123 (ABC) (2021-09-14)
As-built checked by Consultant123 (XYZ) (2021-09-14)
As-built Future created by Consultant123 (ABC) (2021-09-14)

As-built Future checked by Consultant123 (XYZ) (2021-09-14)

And the four superstructure definitions are now:

As-let condition, not including future wearing surface:

Span 1 As-let Condition (2020-03-02) created by Consultant123 (ABC) based on bridge plans ID P123456-B01
Span 1 As-let Condition (2020-03-02) checked by Consultant123 (XYZ) based on bridge plans ID P123456-B01

As-let future condition, including future wearing surface:

Span 1 Future Condition (2020-03-02) created by Consultant123 (ABC) based on bridge plans ID P123456-B01
Span 1 Future Condition (2020-03-02) checked by Consultant123 (XYZ) based on bridge plans ID P123456-B01

As-built condition, not including future wearing surface:

Span 1 As-built (2021-09-14) created by Consultant123 (ABC) based on as-built bridge plans ID P123456-B01
Span 1 As-built (2021-09-14) checked by Consultant123 (XYZ) based on as-built bridge plans ID P123456-B01

As-built future condition, including future wearing surface:

Span 1 As-built Future (2021-09-14) created by Consultant123 (ABC) based on as-built bridge plans ID P123456-B01
Span 1 As-built Future (2021-09-14) checked by Consultant123 (XYZ) based on as-built bridge plans ID P123456-B01

All members within the superstructure definitions shall produce a rating factor greater than or equal to 1.0 using the LRFR methodology. Bridges load rated in software other than AASHTOWare BrR shall follow a similar procedure to reflect the as-let and as-built structure with and without a future wearing surface.

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4. Load Rating Procedure for Bridges with Unknown or Partial Plans

The load rating procedure for structures whose complete or partial plans are unavailable should generally adhere to the guidelines set forth in this document only after all avenues for locating existing plans have been exhausted. This includes, but is not limited to:

- As-let and/or as-built plans stored with the SCDOT, district, county, design engineer, fabricator, and/or contractor
- Rehabilitation plans
- Widening plans
- Shop drawings
- Working drawings

Note: Engineering judgement governs above all guidance provided herein. It shall be the responsibility of the load rating engineer to make justified assumptions that produce an accurate load rating for the structure with unknown components.

Use of Standard and Sister Plans

A bridge may be considered a sister structure if, using engineering judgment, the relevant load rating input is reasonably matching. Standard plans or plans of a sister structure may be used to generate the load rating model if the following criteria are met.

If standard plans are used to generate the load rating model:

- The date of the original signed standard plan must precede the date of NBI Item 27, Year Built, for the subject bridge.
- It is determined during the initial site assessment, using engineering judgment, that the structure has been constructed according to the standard plan(s) in question.

If sister plans are used to generate the load rating model:

- The subject and sister structure were constructed within a reasonable time period of each other.
- It is determined during the initial site assessment, using engineering judgment, that the structure has been constructed (within reason) according to the sister plan in question.

Sister structure plans used to generate the load rating may originate from anywhere in the state and are not restricted to same districts or counties. If standard or sister plans are used to generate the load rating, it shall be documented in the *Remarks* section of the Load Rating Summary Form (LRSF), including the date of the standard plans or the Asset ID of the plan set utilized.

If the structure does not meet either of these criteria for standard or sister plans, the following guidelines should be used.

Field Measurements

All components of the structure necessary to produce a load rating model in an approved software program should be field measured and well documented during a detailed site assessment.

Reinforcement of Concrete Structures

Exhaustive measures should be taken to determine the reinforcing in structural elements that would affect the load rating. The second paragraph of Section 6.1.4 of the AASHTO Manual for Bridge Evaluation (MBE), 3rd Edition, shall be revised to the following:

~~*A concrete bridge or concrete bridge length culvert with unknown details need not be posted for restricted loading if it has been carrying normal traffic for an appreciable period and shows no distress. The bridge shall be inspected regularly to verify satisfactory performance. A bridge may also be load tested to determine its capacity.*~~

If a concrete bridge or concrete bridge length culvert with unknown details has been carrying normal traffic for an appreciable period and shows no signs of distress under normal traffic, the load rater shall generate a load rating model intended to replicate a similar design of the original structure.

The load rater should determine the design loading based upon NBI Item 31, Design Load, from the most recent NBI report, provided it seems reasonable. During the detailed site assessment of these bridges, the assessors shall look for and document the presence of any markings on the bridge that indicate design loading, often stamped on exterior precast elements. This design load marking shall govern over the NBI database information for Item 31.

If the structure is coded Other or Unknown and the original design loading is otherwise undeterminable through engineering judgment, the load rater may base the live load in the model on Table 1 below. Reinforcement should be incrementally added to the load carrying members, following reinforcing patterns of similar bridges constructed during the same time period, until a design load rating factor as close as reasonably possible to 1.0 is achieved.

Facility Type	Design Load
Interstate	HS-20
Other Primary Routes	H-15
Secondary Routes	H-10

Table 1 – Design Load & Facility Type Correlation

Once the reinforcement is established for the design load, posting should be determined based upon the legal loads in accordance with the Load Rating Guidance Document (LRGD). The bridge shall be inspected regularly to verify satisfactory performance. A bridge may also be load tested to determine its capacity.

The intent of this revision is to establish, to the degree possible with the available information, the reinforcing most likely present in the members based upon the load for which the structure was designed. Because member capacity is also a function of material strength, a conservative estimate should be used in accordance with the *Material Strength* section below. If this procedure is used, it shall be stated in the *Remarks* section of the LRSF.

If this procedure cannot be used for some unforeseen reason, or the load rater believes that destructive and/or non-destructive testing could avoid the need for posting, a BMO approval shall be requested to perform testing on the structure.

If a concrete bridge or concrete bridge length culvert with unknown details shows signs of distress under normal traffic, a request to perform material testing shall be submitted to BMO for approval. The signs of distress shall be documented in the BMO Approvals Form.

Material Strength

Generally, the material strength may be conservatively estimated based on the year of construction. Refer to the material strength tables in Section 6 of the MBE. As per LRGD Section 6.12, if material strength estimates, based on year built, would produce overly conservative ratings, material testing may be utilized as described in the LRGD, pending BMO approval. All material strength assumptions shall be documented in the *Remarks* section of the LRSF.

5. Barrier Load Distribution for Transversely Post-Tensioned Elements

If a precast channel- or slab-type superstructure, where the load carrying members are transversely post-tensioned, is load rated using a live load distribution factor equal to 0.5, the weight of any barrier or median load should be applied to the member immediately supporting it and not distributed to any adjacent members. It is assumed the members are acting independently of each other and no load is distributed across the member joints. If this assumption is made, it shall be stated in the *Remarks* section of the Load Rating Summary Form.

6. Load Rate Gusset Plates

Truss gusset plates shall be rated and included in the load rating of truss structures.

7. NBI Item No. 411 (Date Last Rated) (*HD027)

Question:

National Bridge Inventory (NBI) Item No. 411 (Date Last Rated)

We'd like to ask if the date that's input in this box should be the same date the Load Rating Summary Forms (LRSF) was signed. To my knowledge, there hasn't been exact guidance for this, but it seems good if all consultants used the same practice (date LRSF was signed instead of: date it was originated and sent through for checking, date that independent Quality Control began, or some other date). Furthermore, if Michael Baker International Quality Assurance (QA) results in a change to the rating, that Item No. 411 be changed to the date the LRSF is re-signed after the QA comments were addressed.

Answer:

Yes, the date last rated should be the date the LRSF is signed. Item 411 may remain the original signed date if the Asset ID is selected for QA and requires the LRSF to be re-signed to avoid the rework associated with updating all forms that Item 411 appears.

8. Data Correction Form NBI Item 31 – Design Vehicle Added Menu Items

For NBI Data Item 31 – Design Vehicle in LRGD Appendix A5.1 Data Correction Form, three new items (A - HL93, B - Greater than HL93, and C – Other) have been added to the Recommended Corrected Data Column drop down menu list. One of these should be selected when applicable (and when Items 0 through 9 are not applicable.)

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*Previous Load Rating Project Help Desk Reference, either copied or updated for this Technical Note.

Please direct any questions concerning the above to:

Michael Baker International
e-mail: SCDOT_LR_Help_Desk@listserv.bakerprojects.com

Skinny Leg Channel Visual Guide

Visual Guide for Distribution Factor Selection

Based on the results and observations of the channel bridge load testing completed 2-28-2020 by WSP, the following Visual Guide was developed to assist in determine the distribution factor of 2.5" leg channel bridges in South Carolina. WSP's findings concluded that there was strong correlation between the degree of reflective cracking in the deck and the corresponding Distribution Factors. In all cases the distribution factors were found to be at or above the AASHTO LRFD and LFD codes. We recommend engineering judgment be utilized in conjunction with this visual guide in determining distribution factors for load ratings of this bridge type.

If post-tensioned rods are sounded and not identified as being loose or broken, the distribution factor for the 2 ½" leg channels can be based on the degree of reflective cracking. Following photos provide visual guide for the inspector's reference. If post-tensioned rods are loose when inspected, use 0.5 distribution factor for the LRFR load rating regardless of degree of reflective cracking. Double the distribution factors recommended here for LFR ratings.

Reflective Crack Condition	Tie Rod Condition	Recommended DF (Lane)
None/Minor	Good	Follow AASHTO
Moderate	Good	0.35
Severe	Good	0.5
Any Condition	Poor/Loose	0.5

Reflective Cracking: None/Minor – DF = Follow AASHTO

Reflective Cracking: Moderate – DF = 0.35 Lane

Reflective Cracking: Moderate – DF = 0.35 Lane

Reflective Cracking: Severe – DF = 0.5 Lane

Reflective Cracking: Severe – DF = 0.5 Lane

Reflective Cracking: Localized Severe – DF = 0.5 Lane